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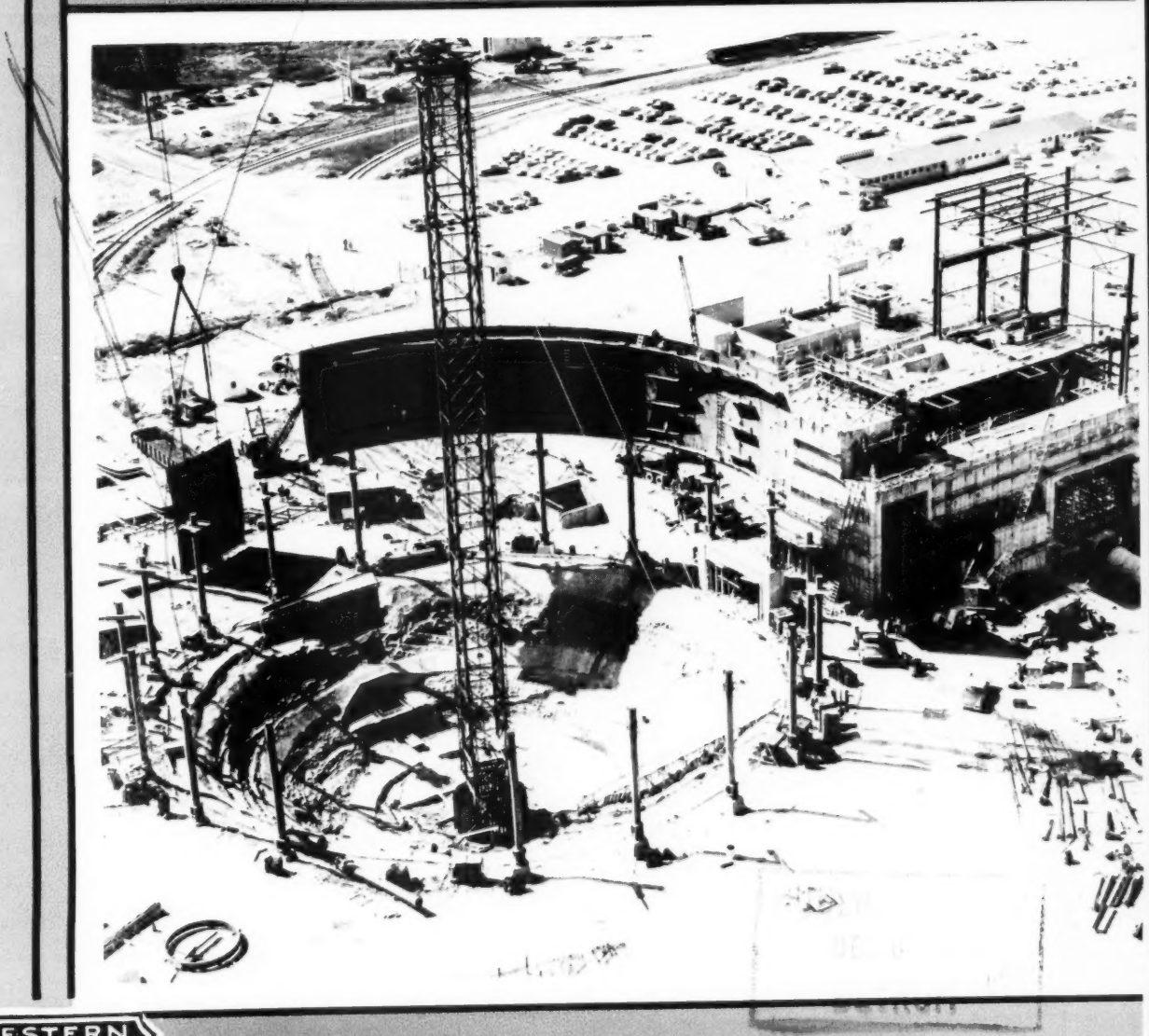

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

RADIATION WORKS FOR YOU — PAGE THREE

Vol. 10 OCTOBER, 1957 No. 5

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MIDWEST ENGINEER
Published Monthly
BY
THE WESTERN
SOCIETY OF ENGINEERS
AT
84 EAST RANDOLPH STREET
CHICAGO 1, ILLINOIS

GENERAL AND EDITORIAL OFFICES
HEADQUARTERS OF
WESTERN SOCIETY OF ENGINEERS
84 E. RANDOLPH STREET
CHICAGO 1, ILLINOIS
TELEPHONE: RANDOLPH 6-1736

Single Copy .....$ .50
Annual subscription 4.00
Foreign subscription 6.00

Entered as second-class matter at the post office at Chicago, Illinois under the Act of March 3, 1879.

Midwest Engineer

A Publication of the
WESTERN SOCIETY OF ENGINEERS
Serving the Engineering Profession

October, 1957 Vol. 10, No. 5

CONTENTS

COVER STORY

Construction is progressing rapidly on Commonwealth Edison Company's 180,000-kilowatt Dresden Nuclear Power Station on the Illinois waterway, 50 miles southwest of Chicago.

In the foreground workmen are installing sections of the 190-foot steel sphere which will house the plant's boiling water reactor. At the right is the turbine generator building.

The station, which is scheduled for completion in 1960, is being built by General Electric Company for a contract price of $45,000,000. Associated in the project with Commonwealth in paying $15,000,000 of the cost as a research and development expense are American Gas and Electric Service Corporation, Bechtel Corporation, Central Illinois Light Company, Illinois Power Company, Kansas City Power & Light Company, Pacific Gas and Electric Company and Union Electric Company.

Field Trip

to the new

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December 3

You'll want to be in on this!

Is communications your interest? The workings of the new Automatic Electric Company Plant in Northlake, Illinois, a pioneer in automatic telephone communications, will be of special interest to you. Are ultra-modern building and construction features your interest? The 35 acres of floor space under one roof, incorporating the newest in design and a truly unique method of construction will be of special interest to you. Is electrical power your interest? This self-contained city, with enough electrical power to supply a city of 10,000 will be of special interest to you. In short, if you want to see tomorrow's industry in operation today—Automatic Electric is it!

The WSE sponsored Field Trip will begin at 7:30 p.m. at the Northlake plant. If a sufficient number of people request it, bus transportation will be provided at nominal cost and will leave Western Society Headquarters, 84 East Randolph, at 6:15 p.m.

If you plan to drive to Automatic Electric, take Lake street or North avenue to Wolf road, then turn right on Wolf road about one-quarter mile to the plant.

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Radiation Works for You

By H. Gladys Swope, MWSE

The public press, radio and TV acclaim the use of atomic energy as a source of power but not so much attention is given to the use of the spent fuel rods. The spent fuel rods, however, are a powerful source of gamma rays which can be used for food preservation, drug sterilization, for plant breeding, for destroying insects, for the polymerization of organic molecules, for the production of heat resistant plastics, and for the initiation and/or change of the course of chemical reactions.

As spent fuel rods must be cooled for a period of time prior to reprocessing for the recovery of the uranium, the use of the gamma rays emitted during this cooling off period is desirable. This article will describe the high level gamma source in use at the Argonne National Laboratory and will briefly review some of the benefits obtained by the use of an otherwise atomic waste product—the spent fuel rod.

Description of the Argonne High-Level Gamma Facility

The Argonne National Laboratory uses spent fuel rods from the 40 megawatt Materials Testing Reactor in Idaho. These rods are shipped in a special carrier, four at a time, to Argonne via rail. They are then placed in an underwater rack for use as a source of gamma rays.

When the fuel rods are removed from a reactor they must be cooled for a period of time. During this "cooling off" period the rods are a powerful source of gamma rays emitted from the fission products in the spent fuel. Gamma rays are highly penetrating rays, similar to X-rays.

At Argonne the fuel rods are placed in a honey-comb arrangement as shown in Figure 1. Twelve fuel rods are used in the rack. The circles represent the

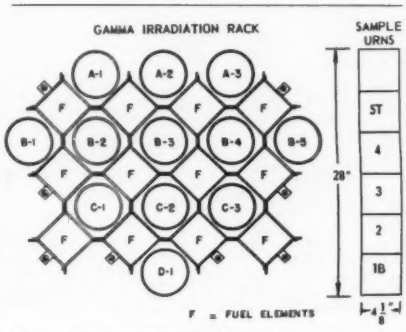


Figure 1.

sample ports and six of these sample ports are surrounded by four fuel rods, while the sample ports on the outer periphery have two fuel rods next to them. The samples are placed in cylinders called urns and these hold five No. 2 cans.

The irradiation rack is 24 in. x 34 in. and 37 in. high measured from the lower plate. Below the lower plate are a series of gears. The cups are attached to the gears and the urns fit into the cups so that they are rotated at 2 r.p.m. during irradiation. This rack is located on the bottom of a canal which is 28 ft. long, 14 ft. wide and 24 feet deep. The depth of water in the canal varies from 16 to 20 ft. An artist's drawing of the gamma facility is shown in Figure 2. Demineralized water (45,000 to 50,000 gallons) is used in the canal and the water is constantly recirculated at the rate of 1,000 gallons per hour through a mixed bed ion-exchange unit. The ion-exchange unit is shown at B and the control panel board for the unit is A. The pumps are shown at D and J. When tap water is demineralized as make-up due to evapor-

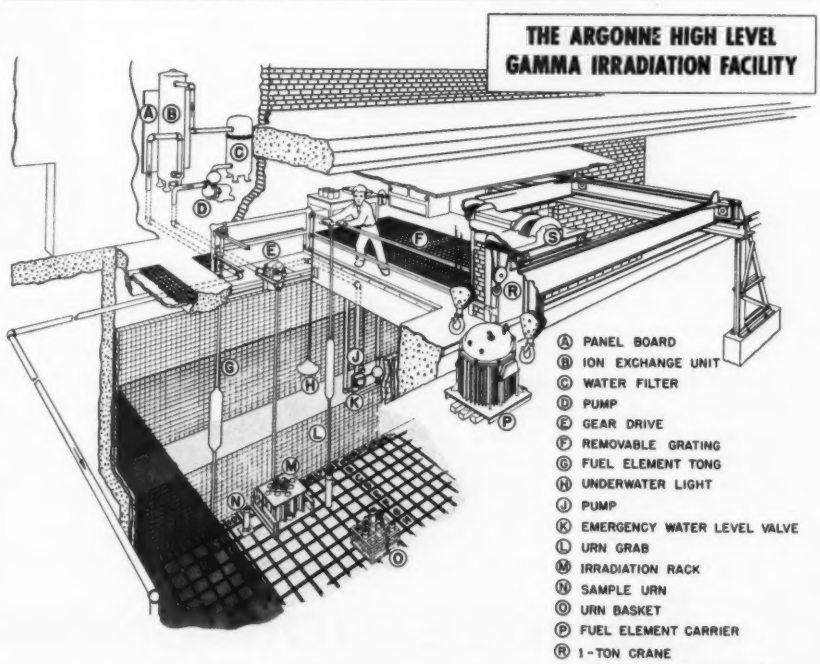
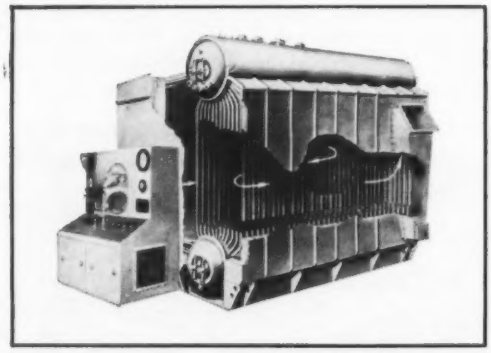


Figure 2.

H. Gladys Swope, Sr. Chemist, Chemical Engineering Division, Argonne National Laboratory, won a First Prize of $100 for this paper in the Western Society of Engineers 1957 Prize Paper Competition.

Architect's rendering of the Lake Meadows project. Skidmore, Owings and Merrill, Architects.

Chicago's newest planned community is served by C-E Boilers



Cutaway view of typical VP Boiler. For capacities from 4,000 to 40,000 lb of steam per hr. Pressures to 500 psi. Oil or gas fuel.

Firing aisle of the Lake Meadows boiler room showing three of the five C-E Package Boilers, Type VP.

Located on a 100 acre site overlooking Lake Michigan, Chicago's newest planned community, the Lake Meadows project, offers gracious living within the confines of a large city. Owned and managed by the New York Life Insurance Company, Lake Meadows provides distinctively appointed apartments, spacious grounds, a modern shopping center, ample parking facilities, yet is within minutes of the heart of the city. When completed, this project will house 2000 families and will include an eight acre park. Construction has already begun on a new elementary school located on two acres adjacent to the housing development.

A project of this size requires considerable steam capacity to provide ample heat and hot water as well as to perform the many other services required. To do the job, the New York Life Insurance Company originally selected three C-E Package Boilers, Type VP. Later, as new housing units were added, two additional VP Boilers were installed. Their outstanding performance and efficient, trouble-free operation is evidenced by the repeat order placed with Combustion for the final two units.

Complete information on C-E Package Boilers is available in Catalog VP-3. Write for your copy.

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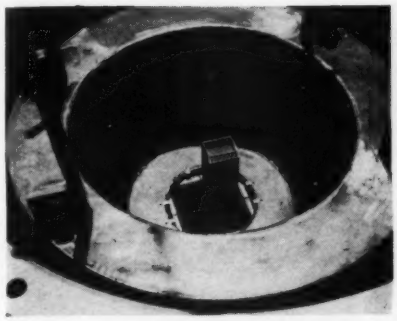

Figure 3. Fuel Rod Carrier

ation of the canal water, it is first passed through the filter shown at C.

The irradiation rack, M, is shown at the bottom of the canal. Below the bottom plate of the rack are a series of gears; the gear drive E, is above the water. Samples are loaded into the urns on the floor level F and the urns are placed in a basket, O, which is lowered by a one-ton crane to the bottom of the canal. The urns are taken out one by one by the use of the urn grab, L, and placed in the irradiation rack by an operator, while another operator starts a timer. Samples are left in the rack for a specified length of time, the time depending on the dose requested and the intensity of the source. The floor of the canal has been ruled off into squares and a sample urn N is seen at point B 10-11. The floor has been marked so as to accurately locate the position of samples outside of the rack. These positions are used when irradiation dose levels below 5000 r are required.

As the fuel rods are decaying constantly, four fuel rods are replaced every six weeks. These are transported by rail from Idaho in a stainless steel lead lined, thirteen ton container, P. The inside of the container is lined with 11½ inches of lead for shielding and contains 150 gallons of water for cooling. After the stainless steel outer cover is removed and the water is monitored, the one ton crane, R, is hooked onto the inside lead cover and the twin hook, 15 ton crane, S, is hooked onto the carrier and the whole is lowered down to the floor of the canal. A photograph of the inside of the fuel rod carrier is shown in Figure 3. The four fuel rods are then moved, one at a time by means of the fuel rod tong, G, to the fuel rod holders in the rack, M. The water in the canal is lighted by means of three underwater lights one of which is shown at H.

In case a leak would develop in the canal and the water would reach the 7 ft. level, the emergency water level float valve, K, would go into action and water would flow automatically into the canal.

The canal itself is a concrete structure. The walls and floor are of 15 in. reinforced concrete on top of which has been sprayed 2 in. of Gunite. The floor is painted white, while the sides are lined with white, glazed six inch ceramic tile.

The intensity of the source is measured by means of ferrous sulfate in dilute acid solution. The ferrous ion is oxidized to ferric ion, the change being measured on a Beckman spectrophotometer and the intensity of the source is calculated.

The fuel rods received at Argonne not only have been in the reactor for varying lengths of time but their cooling times may also be different. The intensity of the radiation in each sample port therefore is different from every other sample port. The relative gamma

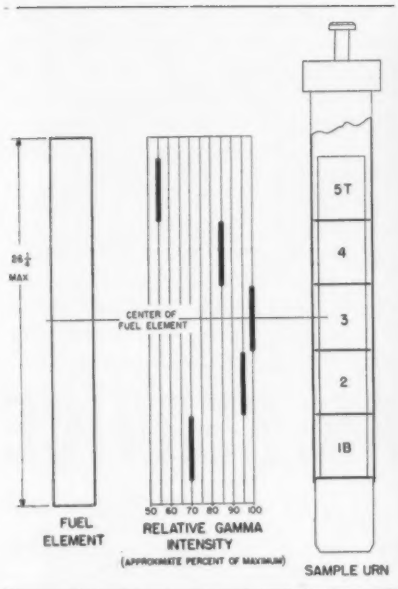

Figure 4.

intensity in per cent of the maximum intensity within a sample urn for one set of fuel rods is shown in Figure 4.

In the sample ports surrounded by four fuel rods the intensity may be as high as 3 million roentgens per hour. Where two fuel rods are adjacent to a sample the intensity will not be greater than 2 million roentgens per hour.

Since the fuel rods are of varying intensity and the gamma ray spectrum is multi-energetic it is necessary to determine the intensity of the source daily. Samples received for irradiation may require doses as low as 1000 rep or as high as one billion rep. A rep is the roentgen equivalent physical and is the quantity of any ionizing radiation which produces an absorption of 93.1 ergs/gram of tissue. The roentgen is equivalent to the absorption of 93.1 ergs/gram of water.

A typical operational scene is shown in Figure 5. Samples which have been loaded into urns are placed in a basket and the operator is shown lowering the basket by means of the one ton crane to the floor of the canal. Each urn will then be picked up by means of an urn grab and placed in the proper rack position for a specified length of time. The irradiation time required is based on the dose requested and the intensity of the source. If the intensity of the source is exactly 2 million r per hour and a dose of 1 million r is requested the samples will be left in the irradiation field for half an hour.

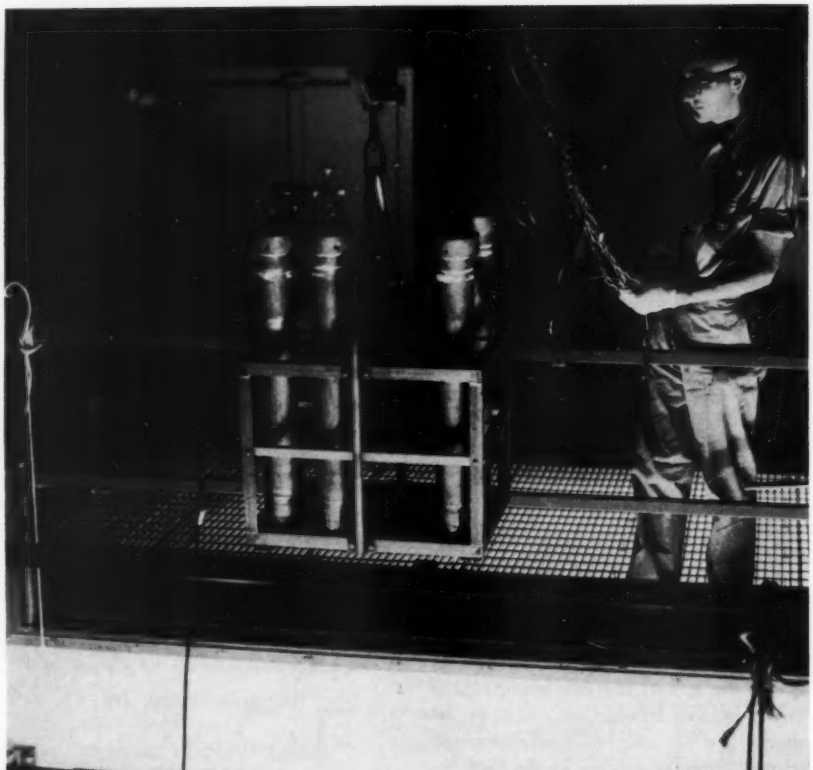

Figure 5. Typical Operational Scene

To illustrate how strong the gamma radiation is let us view the effects of this radiation as photographed, under its own light, shielded by 17 feet of water. In Figure 6, the gamma rack at the Argonne National Laboratory, holding twelve spent fuel rods is photographed.

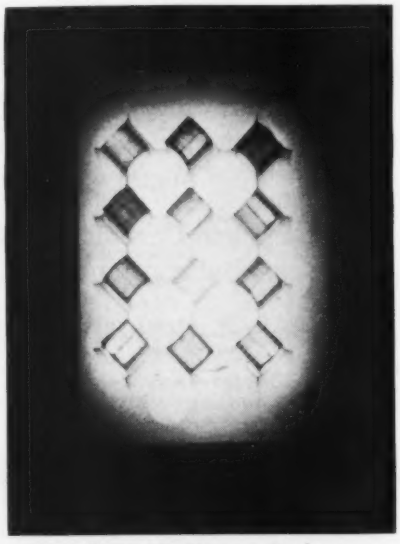

Figure 6. Gamma Rack

The Argonne High Level Gamma Irradiation Facility is a service facility and is available to industry and to educational and non-profit institutions for research.

In the succeeding section a brief resume of some of the many practical applications of gamma rays will be discussed. No effort has been made to cover all of the possible applications.

Applications

Food Preservation

The greatest portion of research on the effect of gamma rays has been devoted to food preservation. Most of this research has been conducted by the Quartermaster Food and Container Institute, the American Institute Foundation and various food companies on the effect of gamma rays for the so-called "cold" sterilization of food. It has been found that by using a dose of three to six million rep food can be kept for six months to a year without refrigeration

(Continued on Page 19)

Importance of Safety Engineering

In the increasingly complex field of structural design, "Safety Engineering" is today recognized as a vitally important area. Among essential safety features that can be engineered into a structure on the drawing boards, lightning protection ranks No. 1 in several types of building, says the Lightning Protection Institute in Chicago.

Several factors — growing costs of building and replacement, increased valuation of real and personal property, not to mention safety of occupants — are working to rate lightning safety at the top among building requisites alongside structural strength, design beauty, and functional excellence.

For instance, lightning is chief villain among fire causes in outlying areas, being responsible for 37 per cent of such fires. Lightning strikes tall commercial buildings repeatedly; it is again No. 1 fire cause in lumber yards; it destroys or damages thousands of homes, and hundreds of churches, grain elevators, oil installations, and factory buildings annually.

For these reasons, the Lightning Protection Institute is enlarging its services to structural designers — architects, building engineers and contractors. It is at this level, the Institute believes, that awareness of the needs and technical aspects of lightning protection is most important. These are the reasons:

1. Lightning protection becomes an integral part of the building's equipment, and it is most satisfactory all around to include it in the basic planning.

2. Costs of installation are lowest at the time of construction and inclusion from the outset provides immediate protection.

3. Fire Engineers and Inspectors for insurance companies favor inclusion of lightning protection installations, particularly in outlying and suburban area buildings. At the recent Mutual Insurance Technical Conference in Chicago, Fire Engineers and Inspectors expressed growing concern over mounting lightning fire losses on Shopping Centers, Supermarkets and Lumberyards in outlying suburban area developments around large cities across the country.

4. Control is in the hands of the man responsible for the building's performance. This is important from the standpoint of appearance as well as to insure proper installation.

5. Inspection and securing Underwriters and other approval, fees for supervision, etc. all follow proper channels when handled in the same way as that for other necessary equipment, such as heating or wiring.

Cause and Effect

Lightning is a gigantic electric spark containing tens to hundreds of millions of volts and sometimes terrific amperage —from 1,000 to 340,000 amperes. It can smash a major building to bits, or it may merely cause structural or surface damage. It is probably more likely to cause fire than not.

"Cold" lightning is high voltage with low amperage and strikes and dissipates at a speed of about 1/10,000 of a second,

seldom causing fire, but the tons of pressure of its expanding gases will explode parts of the building or other target.

"Hot" lightning — low voltage with high amperage—is the fire-setting variety. Its high-current, long-duration core path reaches a temperature up to several thousand degrees.

In either case, lightning is the result of an overpowering attraction between opposite electrical charges in the ground and in storm clouds. Here's what happens:

When storm clouds gather, humid air condenses to raindrops, water turns to ice crystals inside violent air currents, and there is a resulting separation of electrical charges. Usually, negative charges accumulate in the lower part of the cloud, while positive charges build up in the earth and in the upper part of the cloud. When the attraction between these opposite charges becomes strong enough, they leap across the gap of non-conducting air between, and there you have—lightning!

A Corona-like negative streamer usually starts downward from the cloud, establishing the downward path of the stroke. As the stroke leader nears the earth, positive ground charges rush into the area below. Often, ground charges produce upward streamers straining toward the downward stroke leader. The object that holds the highest upward streamer is most likely to be struck.

This explains why lightning usually hits the highest object in the area, and also why air terminal points are used as the uppermost extensions of lightning rods.

A Safe Path

The lightning rod, invented by Benjamin Franklin after the famous kite and key test, has been described as the world's most perfect invention. Correctly installed and connected to properly designed roof and ground conductors, the lightning rod rarely, if ever, fails to safely convey a lightning stroke into the ground, or dissipate it harmlessly in the air.

When is it necessary to install lightning protection equipment? When is it safe to forego specifying such an installation?

There is no workable formula for determining lightning's behavior, or to predict its "danger-point."

However, a tall building will almost always be hit before a low building adjacent to it. And an urban house, protected to some degree by skyscrapers, is usually safer than a suburban or country home. The Empire State Building was hit by lightning on an average of 23 times over an 11-year period. In one storm it was hit 42 times in a few hours.

A one-story building or group of plant structures covering a wide area can be expected to suffer many strikes in its life-time, too, because of area-exposure rather than height. Here's a possible guide:

The average number of lightning strikes for any single area across the country is 40 to 60 per square mile per year, based on average of 40 area thunderstorms annually.

A property that is 650 ft. by 900 ft. is equal to about 1/45 of a square mile. This converts into the fact that this property might be hit by lightning on an average of at least once per year.

Three Types of Rod Installations

Generally, there are three types of lightning rod installations available today: (1) Exposed, (2) Semi-concealed, and (3) Concealed systems.

In an Exposed system, the cables are inconspicuously installed on the exterior of the existing building by taking advantage of placement behind downspouts and other building features. Longer air terminals are often preferred, with ornamentation such as weather vanes included.

A Semi-concealed system has low air terminals that are barely visible and inconspicuous conductors. A Fully-concealed system is installed during new construction, with only the neutral-colored 10-inch-high points showing.

Design of a rodding and grounding system varies with the type of building, height of points, and of course, the type of system.

Detailed information on installing for specific types of buildings, home, farm, industrial, commercial, are available free. For full information and free literature on Lightning Protection and the "Big Business Opportunities in Installing Lightning Protection Systems" write to: Lightning Protection Institute, 53 West Jackson Boulevard, Chicago 4, Illinois.

'Nonburning' Fuels

Three suggestions for a nonflammable fuel that would save lives in transportation accidents and home fires have been made by *Chemical Week*. The proposed fuels include one in the form of two inert fluids that would ignite only when combined inside a combustion chamber, another with a flame-inhibiting additive that would be eliminated under engine operating conditions, and one with a compound flammable only in the presence of both heat and a catalyst.

New Meteorite Theory Supported

Evidence to support a new theory about the formation of meteorites has been reported by three physicists from three different countries who worked together in the Chicago area.

The new theory is that meteorites result from collisions between planets or asteroids comparatively recently in the scale of celestial time. These parent planets or asteroids were formed at about the time of the formation of the earth, the scientists believe. (Note: An asteroid is a small planet-like body which revolves in an orbit around a star, such as the sun.)

The scientists are David C. Hess of the Argonne National Laboratory, Lemont, Illinois; Johannes Geiss of Bern, Switzerland; and Friedrich M. Begeman, of Mainz, Germany. While working on the new theory, Geiss and Bergemann were associated with the Enrico Fermi Institute for Nuclear Studies at the University of Chicago. The findings of the three scientists have been reported in *Physical Review*.

Studying meteorites that fell in Norton County in northern Kansas, and Furnas County, Nebraska, which adjoins Norton County, both part of a 1948 meteor shower, the scientists found that the two bits of rock from the sky may well have been traveling in space for 240-280 million years. (A meteorite is a meteor that has fallen to the earth.)

A sample of the Norton County meteorite was obtained from the American Meteorite Museum, Meteor Crater, Arizona, and a sample of the Furnas County meteorite was obtained from the State Museum, University of Nebraska, Lincoln.

For only a few moments were these bits of rock visible, even with the most powerful telescope, for a meteor does not become a "shooting star" until it reaches the earth's atmosphere. Friction of the atmosphere produces heat, and the meteor appears to "burn."

Not only had the meteors been traveling for possibly 240-280 million years, the scientists concluded, but each was originally a part of a planet that had been in existence approximately 4.2 billion years before it was thrown into space.

The scientists base their conclusions on studies of the amounts of certain elements within the meteorites and of the radioactive decay of one element to another.

Elements can gradually lose small portions of themselves, releasing particles of energy, decaying into other elements. Uranium and radium, for instance, decay over a long period of time into lead. It is possible to measure the "lives" of these elements by computing the rates at which they decay.

Atoms of potassium-40, an isotope or a species of potassium in which the atoms are of uniform atomic weight composing a small percentage of all natural potassium, decay to produce an isotope of another element, argon-40. By measuring the amounts of potassium-40 and argon-40 in a meteorite, it is possible to estimate the time since the meteorite attained its present mineral form. In doing this, the scientist begins

with the known rate of decay of potassium-40 to argon-40, that is just how much will decay over a given period of time.

Geiss, Hess, and other researchers have tested several meteorites this way, finding that their potassium-to-argon ages are between 4 and 4½ billion years. This is approximately the age of the earth, the moon, and the planets in our solar system. The age of the Norton County meteorite was computed by the potassium-to-argon method to be about 4.2 billion years; the potassium-to-argon age of the Furnas County meteorite was not computed.

Two other isotopes, hydrogen-3 (tritium) and helium-3, gave Begemann, Geiss, and Hess the key to their explanation of how meteors may be formed.

Cosmic rays, found in space, continuously bombard a meteor during its flight. They affect its chemical makeup, producing helium-3 and causing hydrogen-3 to decay to helium-3. Knowing the speeds at which these two reactions proceed under cosmic rays, the scientists were able to compute the lengths of time that the Norton and Furnas County meteorites had been subjected to cosmic bombardment. This turned out to be 240 million years for the Norton County meteorite and 280 million years for the meteorite that fell in Furnas County.

So far evidence indicates that cosmic rays have been constant in their intensity for at least the past one hundred thousand years. If cosmic rays have had their present intensity for about five hundred million years, then according to the three scientists, the 240 and 280 million-year meteor "age" figures must be true. Moreover, in order not to have been exposed to cosmic rays before it started its fall, each of the meteorites must have been made up of material that was embedded within a solid planet or asteroid.

What could have split the parent asteroid or planets and sent the meteors on their way to ultimately land on the earth? A very real possibility, the scientists conclude, is that there was a huge collision in outer space.

Hess, a graduate of the University of Denver, Colo., received his doctor's degree in physics in 1949 from the University of Chicago. He is employed as associate physicist at Argonne National Laboratory and has been a member of the Laboratory staff for 11 years.

Argonne National Laboratory is operated by the University of Chicago for the U. S. Atomic Energy Commission. It conducts a complete program of basic research and developmental activity in fields which are important to the atomic energy program.

Chemical Exposition Appoints 12 Chemists

The National Chemical Exposition, sponsored by the Chicago Section of the American Chemical Society, has announced the appointment of twelve outstanding chemists and executives to the Advisory Board of the 10th show, scheduled for September 9-12, 1958 in Chicago. According to Robert J. Reinarts, of E. H. Sargent & Co., chairman of the Exposition's working committees, the following have accepted appointment to the Advisory Board: Thomas H. Coulter, Chicago Association of Commerce & Industry; Lawrence Flett, Consultant: J. H. Forrester, Amoco Chemicals Corp.; T. L. Greshman, A. E. Staley Manufacturing Co.; John E. Hull, Manufacturing Chemists Association; Sidney D. Kirkpatrick, McGraw-Hill Publishing Company; Howard A. Marple, Monsanto Chemical Co.; Walter J. Murphy, ACS Applied Chemistry Journals; George L. Parkhurst, Standard Oil Company of California; C. F. Rassweiler, Johns-Manville Corp.; Ernest H. Volwiler, Abbott Laboratories; Donald Williams, The Dow Chemical Company.

The Exposition is scheduled for the International Amphitheater in Chicago.

Kreml Speaks on Transportation

If the problems of the transportation economy as a whole are clearly defined and rationally dealt with, our transportation system can continue to be the greatest in the world.

Brig. Gen. Franklin M. Kreml, director, transportation center, Northwestern University, made this statement in a speech before the all-society banquet of the 13th annual National Conference on Industrial Hydraulics on Oct. 17 in the Hotel Sherman in Chicago.

The conference was sponsored by Illinois Institute of Technology and its affiliate, Armour Research Foundation, in cooperation with several engineering societies and more than 100 industrial organizations.

"The United States has become a great industrial nation largely because it has been successful in developing regional specialization," said Kreml. "This development depends upon an adequate and economically successful transportation system."

Since the U. S. is the only major national transportation network operating under private ownership in a free enterprise system, he added, it is important, not only to the transportation economy, but to the economy of the United States itself, that the system be continuously strengthened and improved.

Kreml said the critical strains and difficulties besetting the transportation industry stem in part from population and market shifts and the impact of extensive technological change within the system itself, which have brought complications and uneven development.

"There is substantial and long-standing disagreement with respect to the character and extent of regulation required, both between government and industry and within the transportation industries themselves," explained Kreml.

He went on to say that further vitalization of the transportation economy can and is being accomplished by the private managements of individual companies and by joint education and research of private transportation companies and universities.

"From such education and research can come facts, analyses, and conclusions which will benefit all types of transport and ultimately the whole national economy," he concluded.

Chemical Recovery Unit Starts Service

Longview Fibre Company, one of the largest producers of kraft pulp in the Pacific Northwest, has just placed in service the world's largest chemical recovery unit. Designed and built by Combustion Engineering, Inc., the unit has the capacity to burn 2,000,000 pounds of dry solids per day and to generate approximately 300,000 pounds of steam per hour. Eight similar but smaller units of this new design are already in service in various parts of the United States, Canada and Finland.

The power plant at Longview, Washington, has an installed capacity of 45,000 kilowatts. A 350,000 pound-per-hour Combustion boiler was recently added to the plant, which also includes Combustion recovery units installed in 1947 and 1952. Some indication of the progressive increase in size of chemical recovery units may be had by comparing the earlier units, having respective dry solids capacities of 600,000 and 1,050,000 pounds per day, with the latest 2,000,000 pound unit.

Chemical recovery units are designed to burn black liquor from the alkaline pulping industry. Smelt, which collects in the furnace bottom, is continuously drawn off and reprocessed for re-use in the pulping operation. Approximately 3,000 pounds of dry solids are obtained from each ton of pulp produced.

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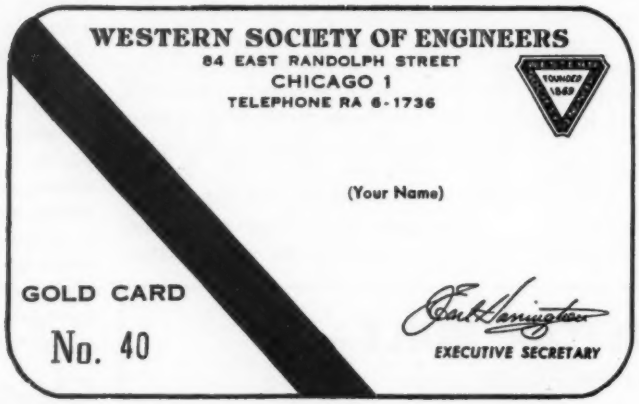

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Ceramics May Solve Problem

Modification of the ancient art of ceramics may help solve one of the big problems of smog and air pollution—automobile engine exhaust.

Ceramic scientists at Armour Research Foundation of Illinois Institute of Technology have developed a catalytic ceramic coating for piston heads which shows promise of significantly reducing the amount of carbon monoxide and unburned hydrocarbons in exhaust gas.

In addition, the coating offers promise of thermal insulation, greater combustion efficiency and, thus, more economical operation, according to Samuel W. Bradstreet, supervisor of inorganic technology at ARF.

The process stems from a method previously developed and patented by the Foundation called "Flame Ceramics," in which coatings are produced by spraying non-metallic powders through a flame gun. Continental Coatings Corp., Chicago, has exclusive license to the process.

Earlier work in "Flame Ceramics" indicated that these coatings might reduce thermal cracking and carbon deposits in diesel engines, Bradstreet said.

On this basis, Foundation scientists developed a flame-sprayable coating containing rare earth oxides which would act as a catalyst in internal combustion engines.

With "about half" of the top area of its pistons coated, a standard automobile engine was run under idling, cruising, and full acceleration and deceleration conditions with non-leaded gasoline and with air bled in at the carburetor intake.

Comparing exhaust data from this investigation with an identical "uncoated" engine test, it was found that the coating decreased carbon monoxide and decreased unburned hydrocarbon proportion, particularly during acceleration and deceleration.

"While so far we have achieved limited effect under idling condition or high cruising speeds, this trial indicates that the coating may have significant effect on gasoline engine exhaust," Bradstreet stated.

"We can assume the effect would be even more pronounced if both piston and cylinder heads were more completely coated with more active materials."

Many problems remain to be considered and solved in the process, he pointed out. For example, there is a possibility of developing a more active and stable coating which should be tested both on diesel and gasoline engines—the latter with leaded fuels.

"There also is evidence that the coating will permit higher surface combustion temperatures and thus reduce carbon formation and lead oxide condensation," added Bradstreet.

It may be possible that the coating would catalyze surface combustion rate sufficiently to warrant reduction of anti-knock additives in gasoline, minimizing the problem of "poisoning" by lead oxide, he said.

At the same time, the coating should restrict thermal transfer and, thereby, increase life expectancy of pistons and heads. Further research, along with regard to such matters as air-fuel mixtures and anti-knock and pre-ignition effects, should determine the full possibilities of the coating, Bradstreet said.

The Foundation will continue the investigation under outside sponsorship.

Ormas G. Smith, (right), chief engineer of Illinois Bell Telephone Company and president of the Western Society of Engineers, receives one of the first calls as the year-long tests of air-to-ground telephoning opens, from K. V. Glentzer (left), MWSE, Illinois Bell radio and special services engineer, who is testing the phone from a plane.

Air Telephone Service Opens

Telephone service for airplane passengers was opened Sept. 15 on a trial basis over the Chicago and Detroit areas, Illinois Bell Telephone Company announces.

Participating in the year-long tests of air-ground telephoning are one government and 11 private planes. Passengers aboard these planes can be connected to home or office phones while flying above the Chicago-Detroit vicinity. Thus, Husband John can call Wife Mary to tell her he'll be flying in for dinner at 6.

The experimental service was authorized last April by the Federal Communications Commission for a one-year period.

"The objective is to determine the feasibility of establishing regular air-ground public telephone service on a more widespread basis," K. V. Glentzer, MWSE, Illinois Bell radio and special services engineer, says.

Radiotelephone units aboard the planes, will be connected to the nationwide telephone system via ground radio stations operated by Illinois Bell and Michigan Bell Telephone Company. Special "aviation operators" will make the connections.

In making an air-ground call, a plane passenger presses a push-talk button on his air-borne phone. This sends a signal to a base station and thence to a special aviation switchboard operator. Upon reaching the operator, the passenger gives her the number he wishes to call and she makes the connection. For ground-to-air service the procedure is reversed.

Illinois Bell's radio antenna, used for this service, is on a mast already used for vehicular radiotelephone service. It is located atop the 550-foot Field Building, 135 S. LaSalle Street. Aviation operators will be at a switchboard in Illinois Bell's headquarters.

The telephone companies are using, on a temporary basis, two radio frequencies on an unused common carrier channel previously assigned to land mobile telephone service. Since only one channel will be used for the experiment, only one conversation may take place at one time through each base station.

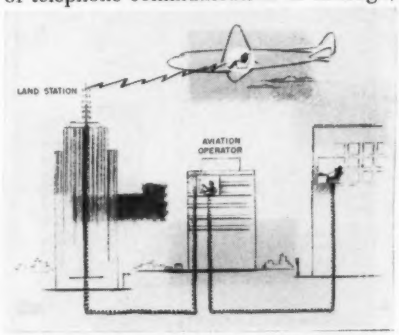
The airborne communications equipment in the initial test service consists of small lightweight sets manufactured by AC Spark Plug Division of General Motors Corporation and Motorola, Inc. Other manufacturers expected to provide

units later in the tests include Bendix Aviation Corporation, and Radio Corporation of America.

Rates for the one-year trial service will range between $1.50 and $5.25 for a three-minute call, depending on the location of the plane and the other party that is calling or being called. For example, a call between an airplane over Milwaukee and a Chicago telephone would cost $1.50 for the first three minutes. Both parties are located within the same zone.

A call between a plane over Cleveland and a Chicago phone, the charge would be $2.15 for the first three minutes, because the call would be from one zone to another.

Glentzer said establishment of air-ground service will complete the cycle of telephone communication in Chicago, which began in 1877 when the first phones were installed. Telephone service for water craft came in 1942. Mobile telephones for automobiles started in 1946.



Sketch showing how telephone call from passenger aboard plane in Chicago area to his home will be handled.

The Bell System's development of radio-telephony in airplanes goes back to 1917 when Bell was active in communications for America's World War I military planes. Since then, voice communications between planes and airport control stations has become a vital part of aviation—although this is the first trial of public telephone services designed for airplanes.

New VHF Technique Aids Data Taking

A new technique of unattended recording of VHF receiver site noise which eliminates the fallacies of human judgment in the obtaining of data was called in Chicago on Oct. 11 "a great step in the improvement of the service by all radio systems."

Robert E. Bloor of the Ohio Bell Telephone Company, Cleveland, Ohio, in a paper prepared for presentation during the Fall General Meeting of the American Institute of Electrical Engineers described and praised the innovation in recording equipment arrangement.

It has been a common practice, he pointed out, to appraise radio receiving conditions by making a talking test and using the listener's ability to understand as the criteria for determining quality.

"While the listener's ability to understand is important," he said, ". . . the judgment of the persons making the test may not correspond to the judgment of the users. The elimination of human judgment in the recording of data will be a great step in the improvement of the service provided by all radio systems."

The use of the new recording method, he said, can also eliminate expensive installations at locations where severe noise is present during a particular part of a day or at infrequent intervals. Occasions have occurred, Bloor explained, where manual tests were made for a limited time, and, based on these tests, installations were made at locations which later proved unsuitable. This has required expensive rearrangements which could have been avoided had more complete data been available prior to the initial installation.

An additional use of the technique, said Bloor, is the determination of the coverage area of a given receiver.

The equipment arrangement, as described by Bloor, includes an antenna and test receiver of the same general type being considered for the proposed installation. This test receiver is used to convert the signal strength of all signals and noise at the receiver site to DC which can be recorded on a recording milliammeter. The effect of the signals and noise on the audio output of the receiver is also converted to DC and simultaneously recorded on a similar recording milliammeter whose paper tape travels at the same speed as the limiter tape. By using this type of recording medium, the data recorded in many hours may be evaluated in a relatively short time.

While making these recordings, the output of a stable signal source, which can be modulated frequently, is coupled to the antenna of the receiver. This signal source reduces the noise in the audio output of the receiver to a present value and establishes a continuous signal strength reference point on the limiter tape. To permit the identification of any strong interfering signals which might occur, the audio output of the receiver is coupled to a conventional magnetic tape recorder which is energized when the strong interfering signal is present.

Ship Hulls Protected Electrically

An automatic electrical system which permanently protects ships' hulls and propellers against corrosion, increasing their useful lives and cutting repair costs, has been developed after several years' research by Charles Engelhard, Inc., one of the Engelhard Industries.

It may make possible the use of steel propellers, according to Engelhard. Much stronger and cheaper than the standard bronze, steel propellers have been impractical heretofore because of their great susceptibility to corrosion.

Called CAPAC, the system already has been installed on U. S. Navy craft and commercial ships. Other applications include Texas oil towers, radar towers, tidal hydroelectric turbines, and pipelines carrying sea water for cooling purposes to oil refineries, steam plants, and other industrial installations.

The impressed-current cathodic-protection device safeguards ships both at sea and at dockside. Since there are no "sacrificial" parts to be replaced, it requires no service or maintenance and can be salvaged intact at any time, the manufacturer said. It can be installed on both old and new ships.

Ship corrosion is a result of a flow of chemically created electricity from one part of the hull to another through the sea. CAPAC neutralizes this flow with a reverse current through the sea to the hull emanating from platinum anodes attached to the hull at strategic points, but insulated from it.

A silver-chloride "reference cell" also mounted on the hull monitors electrical conditions there, and guides an automatic controller which supplies the appropriate reverse voltage to the anodes. The controller draws current from the ship's regular power system.

Protection is extended to the propeller and shaft by grounding them to the hull through a special slip-ring assembly also developed by Engelhard.

Each anode is a circular platinum disc about seven inches in diameter and .005 inches thick, mounted in a polyester plastic holder. The assembly is bolted flush to the hull at the center of an eight-foot-square neoprene blanket cold-bonded to the hull. By insulating the anode from nearby portions of the hull, the blanket encourages the anode to "throw" cathodic protection over large areas of the hull of the ship.

When two dissimilar metals are joined and immersed in a solution such as sea water, an electric current is generated by chemical action. One metal becomes a current emitter, or anode, while the other becomes the current receiver, or cathode. The dry-cell batteries used in flashlights work on this principle.

Unless the anodically charged metal is highly corrosion-resistant, it tends to react chemically with the solution.

The same phenomenon occurs when a steel hull stands in the sea, because variations in the composition of the steel cause it to act like two different metals—some areas become anodic and corrode, while others serve as cathodes. In effect, millions of tiny anodes and cathodes are dispersed over the hull. The amount of corrosion at the anodic points varies with the speed at which the ship is moving, the chemical composition of the sea water, its temperature, and the amount of oxygen dissolved in it.

The impressed current provided by CAPAC overcomes the destructive galvanic current flow. The platinum electrodes take over as the anodes, and the entire ship's hull becomes cathodic to them. Being inert chemically, the platinum does not corrode.

The CAPAC's current also protects the ship in another way: It decomposes the sea-water salt into chlorine and

sodium, which reacts with the water itself to form sodium hydroxide and nascent hydrogen at the cathode. The hydrogen spreads over the ship's hull in a polarized film which is highly resistant to the corrosion-producing galvanic current. The film automatically adjusts itself to variations in thickness of the ship's paint.

A CAPAC current density of two to six milliamperes per square foot is required to protect the average painted hull once it has been polarized. Propellers and shafts, being unpainted, require more. According to Engelhard, one of the major advantages of the platinum anodes is that they can carry high current densities without deterioration.

The constant automatic control provided by CAPAC is essential because too high a protection voltage could cause alkaline attack of the ship's paint, the company said.

The manufacturer described extension of protection to the propeller and shaft as a particularly important development. Expensive to repair or replace, they suffer from an especially damaging local galvanic action. The special slip-ring assembly is required because these parts usually are insulated from the hull by the shaft's bearings and lubricant.

The plastic anode holders and neoprene blankets are unaffected by the electrolytic reactions taking place at the anodes. CAPAC's connecting cables also are sheathed in a corrosion-resistant plastic.

New Techniques on Fluids are Developed

New techniques to obtain basic data on fluids have been developed at the Institute of Gas Technology of Illinois Institute of Technology, Chicago, and California Institute of Technology, Pasadena, Calif.

The techniques were explained in a paper presented Oct. 18 in Chicago by Dr. Rex T. Ellington, assistant research director, and Bert E. Eakin, supervisor of reservoir engineering, both of the Institute of Gas Technology, at the 13th annual National Conference on Industrial Hydraulics.

The conference was sponsored by Illinois Tech and its affiliate, Armour Research Foundation, in cooperation with several engineering societies and more than 100 industrial organizations.

The Institute of Gas Technology has improved a basic mechanism frequently used to determine the resistance to flow of various fluids. The new type of viscometer is based on the forces resulting when a fluid is forced through a small tube.

California Institute of Technology's viscometer is based on the forces resulting when fluid is contained between a stationary cylinder and a rotating cylinder.

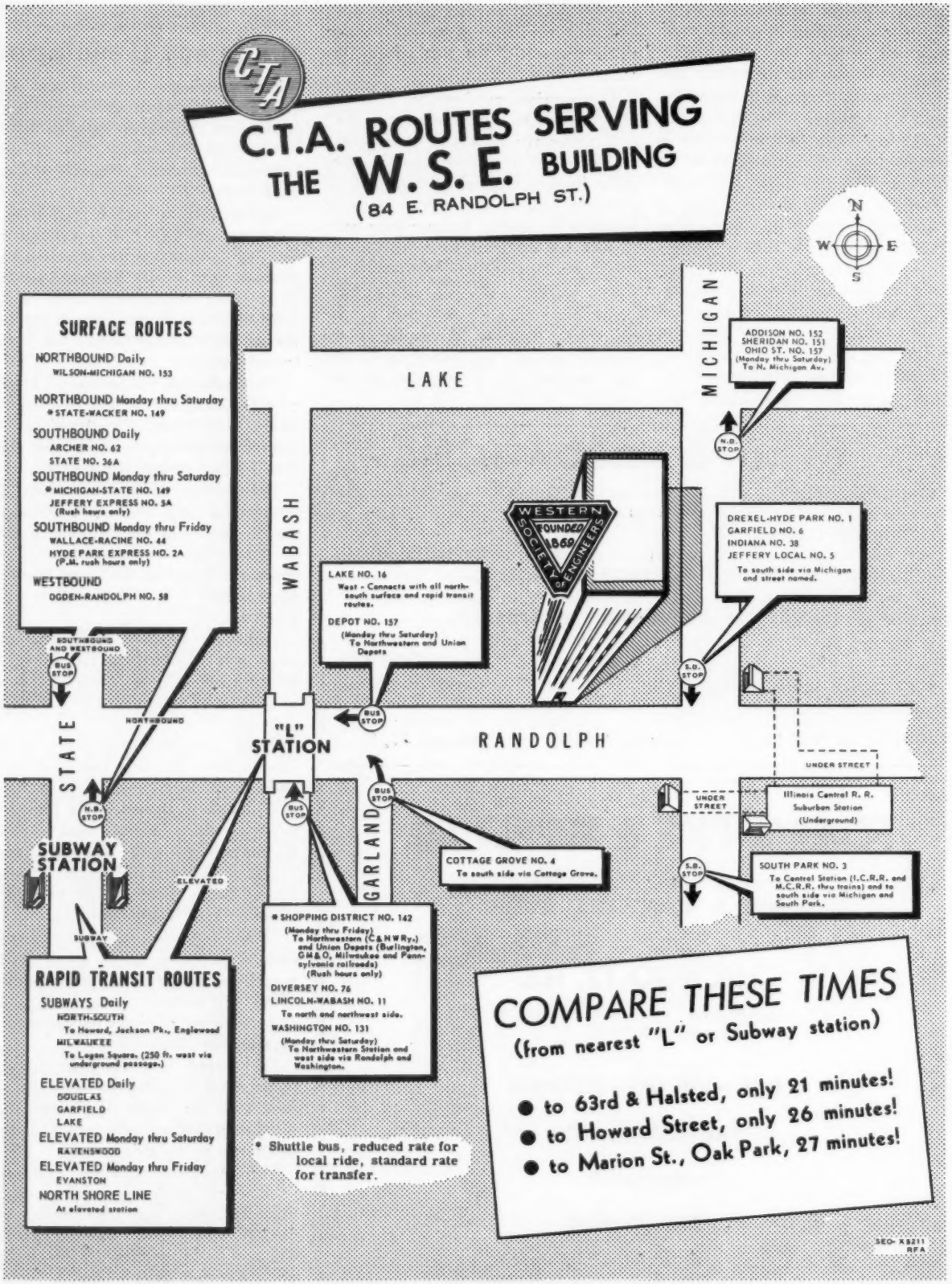
"Facts pertaining to viscosity—resistance to flow—and compression of fluids under high pressure are of great value to hydraulic engineers," said Ellington.

"Apparatus previously used to measure the compressibility of fluids is quite applicable to hydraulic liquids. The current efforts in viscometry are to develop 'absolute' type instruments," he said.

"Both of the new viscometers can be used at pressures up to about 10,000 pounds per square inch," said Ellington. "They will measure through all ranges of temperature normally encountered in high pressure hydraulics."

The current need for high pressure information on hydraulic fluids did not arise until the advent of modern high-speed airplanes, machine tools, and other equipment in use today.

The engineers explained that most viscometers previously used on these fluids had given only data relating one fluid to another; the new apparatuses will give basic, or absolute, information about a certain fluid.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Radiation Works

(Continued from Page 6)

if properly packaged so that bacteria cannot get into it. It has also been found that the shelf life of many meats may be extended 5 to 10 times by a much lower dose, 100,000 to 400,000 rep. Potatoes and onions can be kept from sprouting by a dose of 10,000 to 15,000 rep. Bread, rolls and waffles can be kept from molding for a period of a year or more by subjecting them to a dose of radiation of 500,000 to 750,000 rep.

Sterilization of Drugs and Medical Supplies

Gamma rays have been used to sterilize pharmaceutical products and this method has two distinct advantages. First, the drugs can be sterilized in their packages thereby assuring the user of an uncontaminated product and second, it is possible to sterilize heat-labile pharmaceuticals.

One group studying the effect of gamma rays for the sterilization of antitoxins, hormones and vitamins found that the products should be exposed to 2.04 million rep as measured in air per 24 hours. Of the pharmaceuticals studied all except one, a pituitary substance extract, showed no significant deterioration from the irradiation.

Another important use is the mass sterilization of medical supplies, such as dressings, cotton gauzes, cotton swabs, instruments and human "bone-bank." A 2 million rep dose has been used.

Plant Breeding

Low doses of gamma rays may increase the rate of mutation of seeds ten to 100 times. Irradiation may also develop new or previously unknown mutations. For example, in Sweden a barley with stiffer straw was developed; in German bitter lupine was mutated to sweet lupine which can now be utilized as a forage crop. In the United States disease resistant grains have been developed. Peanuts have been produced which are resistant to leaf spot and stem rot diseases.

Another development is the growing of plants in a gamma field to see what mutations occur. For example, a somatic mutation occurred in a carnation plant which gave a red flower on a white flowering plant. Cuttings grown from the stock having the red flower produced a plant having all red flowers.

Destruction of Insects

A rather low dose of irradiation, 20,000 rep is usually sufficient to destroy the flour beetle. This low dose does not affect the taste of bakery goods made from such irradiated flour. The powder post beetle which damages lumber, however, requires 65,000 rep for even 50 per cent to be killed. In one investigation 322,000 rep killed all species studied within four days. The species investigated were the black carpet beetle, larder beetle, cigarette beetle, rice weevil, the lesser grain borer, flour beetle, powder post beetle and the vinegar fly.

The United States Department of Agriculture is interested in killing insects or in breeding those incapable of reproduction. They have made a study of the effect of gamma rays (5,000 r) on the screwworm fly which is a livestock pest in southwestern and southeastern United States. Screwworms survive the winter, normally, only in Florida. When sterilized male screwworm flies were released to mate with normal females the majority of the egg masses failed to hatch.

Polymerization of Organic Molecules

One of the more important uses of radiation is its effect on organic molecules. These effects have included mechanical and electrical properties and controlled molecular weights. Under irradiation some polymers cross-link, others degrade, still others both cross-link and degrade. Of most commercial importance are those that cross-link. When cross-linking takes place, the side chains of the molecule are fractured and free radicals are formed by radiation and these radicals combine to link adjacent molecules.

Among the polymers that cross-link under radiation are polyethylene, rubber, nylon, polyvinyl acetate, polyvinyl chloride and the acrylic esters. The amount of radiation also effects the amount of cross-linking and thereby the physical and chemical characteristics of the material. For example, the elasticity, temperature behavior, and solubility may be altered favorably.

Production of Heat Resistant Plastics

Under irradiation, 50 to 100 million rep, polyethylene is changed to a rubber-like material which does not melt or flow at temperatures up to 135° C. This makes it possible to heat it above its melting point and mold it into any desired shape. Irradiated polyethylene withstands boiling water and steam and is chemically inert. It also makes it possible to use polyethylene bottles for radiation sterilization of drugs.

Vulcanization of Rubber

Natural rubber, GR-S, neoprene, and a butadiene-acrylonitrile copolymer have been successfully vulcanized by the use of gamma radiation alone; no heat or chemical vulcanizing agents were used. As with vulcanizates prepared by conventional methods, the optimum properties were obtained with the inclusion of reinforcing pigments, anti-oxidants, etc. The aging of the irradiated specimens was particularly good.

Changes and/or Initiation of Chemical Reactions

Gamma rays may be used to initiate chemical reactions, change their course, speed up or retard their progress. Some

chemical compounds that cannot be made even under elevated temperatures and very high pressures are possible with gamma rays.

In many chemical reactions, water is the solvent. Under irradiation water forms H and OH radicals and hydrogen peroxide in varying amounts depending on the nature of the radiation. The radicals are very reactive and have a profound effect on the chemical reactions.

Air, for example, under ionizing radiations, forms ozone. Therefore, if a substance is being irradiated it is necessary to consider the effect of ozone on the compound or chemicals being irradiated or irradiate them in an inert atmosphere or under vacuum.

Organic compounds under irradiation break down, exposing one or more free radicals. These free radicals are extremely reactive making it possible for a chemical reaction to take place.

In addition to free radical formation, ionization may also take place.

Coloration of Glass

Ordinary glass bottles, tumblers and the like turn brown under gamma radiation and the darkness of the brown could be used as a very rough measure of the intensity of the radiation. However, this color is not stable and it is heat sensitive. This phenomena led investigators to seek a glass which would give a stable color and would be insensible to heat, so that it could be used as a measure of the radiation dose. Such a glass was developed — a silver phosphate glass which is used as a personnel monitor for people exposed to radiation during the atomic bomb tests.

At the other end of the scale is the large amount of research being done to find a glass which will not color under extremely high doses of irradiation in order to use glasses as windows in remote control caves. These are caves where very highly radioactive materials are worked on behind thick shields using remote control devices and the operations must be viewed through windows not affected by radiation.

* * *

Since all reactors will have spent fuel rods which must be cooled before processing, why not make these rods perform useful work? The industrial possibilities of gamma radiation are legion.

Dry Ice, Alcohol, and a Reactor

A new method of reactor maintenance —involving use of dry ice and alcohol— has been applied to Argonne National Laboratory's Experimental Boiling Water Reactor.

Details were revealed Oct. 8 by Joseph M. Harrer, project manager, Experimental Boiling Water Reactor, in an address before the American Institute of Electrical Engineers, at the Morrison Hotel in Chicago.

Harrer said the new operation involved freezing water in the lower portion of one of the nine control rod thimbles.

These thimbles are six foot long pipes leading into the control rod drive mechanism, the machinery that controls the rate of reaction, below the reactor vessel.

Freezing was done to provide an ice dam so that maintenance could be carried out below the freezing point without danger of releasing radioactive water from the reactor core.

During EBWR operation, a seal mechanism at the outlet of each control rod thimble, attached to the bottom of the pressure vessel through which control rods are operated, provides a pressure breakdown, i.e., seals water in the reactor.

A device similar to a valve, called a back seating plug, is installed directly above the seal, to service it.

During operation, the back seating plug rises off its seat with the movement of the control rod. During shutdown, the plug is closed by drawing a control rod down tight. Maintenance on the control rod can't be carried out when the plug is off its seat.

In normal maintenance, provision is made to remove the control rod mechanism, when necessary, by dropping the rods until the back seating plugs close at the seal points.

On October 1, said Harrer, EBWR personnel faced a unique problem. They wanted to remove and clean the seal and dash pot, a hydraulic shock absorber, on one of the thimbles, but the back seating plug would not seat, or close. Harrer said this may have been caused by a small chip of metal that lodged itself between the plug and the seal.

This meant that removal of the mechanism would cause leakage of radioactive water from the core.

So to remove and clean the mechanism, some new way of blocking release of radioactive water from the core had to be devised.

The only alternative would be the lengthy process of draining the wate from the core. Harrer said this would take approximately six days of work, around the clock.

Harrer and two associate mechanical engineers, William J. Kann and Charles F. Bullinger, theorized that a mixture of dry ice and alcohol could be applied to the thimble in question, freezing it and providing an ice dam above the back seating plug for a protective shield. With such a shield, maintenance could be accomplished.

Harrer said the group had a four inch area of pipe to work on, between a flange and a steel retainer plate that provides structural retainment for the nine thimbles.

Refrigeration was a two inch deep mixture of dry ice and alcohol in a shallow pan, at a temperature of —70° F.

Harrer said the mixture was applied for five hours. Then the flange was loosened, and there was no leakage. The flange was removed, and examination showed ten inches of ice in the lower portion of the thimble, more than enough for protective shielding. The mechanism to be cleaned could now be removed at will.

After cleaning, said Harrer, the mechanism was reinstalled, the ice thawed, and the machinery pronounced ready for operation, within eight hours from the start of the experiment.

Harrer said this type of maintenance is typical and necessary for all types of reactors.

And he said, "the freezing experiment proves that planned maintenance for reactors can be carried out safely. Unless maintenance of this type could be done, no reactor could be operated safely."

Harrer added that this was the first instance of the freezing technique, used in other engineering areas, being applied to Argonne reactors.

The Experimental Boiling Water Reactor was the first reactor in the nation to go "on the line" and produce large-scale quantities of electric power. It was dedicated on February 9, 1957.

EBWR is a complete direct cycle boiling reactor power plant producing about 5,000 kw of electricity from 20,000 kw of reactor heat in the form of 600 psi steam.

EBWR is an experimental plant intended to prove as much information as possible for future use in designing large central station units.

Argonne National Laboratory is operated by the University of Chicago, under contract with the U.S. Atomic Energy Commission.

What is Air?

What is air?

No one really knows, according to T. H. Chadwick and Paul L. Brady, design group engineers at Convair, a division of General Dynamics Corp., San Diego, Calif.

The two engineers presented a paper on "New Design Concepts for High-Pressure Pneumatics Systems" before the 13th annual National Conference on Industrial Hydraulics in Chicago on Oct. 18.

The conference was sponsored by Illinois Institute of Technology and its affiliate, Armour Research Foundation, in cooperation with several engineering societies and more than 100 industrial organizations.

Air—the most common combination of gases—still has the experts stumped, say Chadwick and Brady. Scientists find air unpredictable at high pressures—so unpredictable that it has "become necessary to employ new and complicated techniques" in order to develop high-pressure pneumatic equipment.

"Design engineers for low-pressure pneumatics and hydraulics don't have this handicap," they explained. "Data is available to them."

Hydraulics differs from high-pressure pneumatics in several ways. Besides the obvious difference in fluid medium—air and water—hydraulics and high-pressure pneumatics can be applied in different ways for different degrees of efficiency.

In a basic cylinder power circuit, it was pointed out, the fields of hydraulics and pneumatics coincide. In some situations, however, hydraulics might be used, but pneumatics might be preferred. In another, the situation presented might be ideal for pneumatics but impossible for hydraulics.

Basically, the objective of high pressure pneumatics is to design an auxiliary power system in an aircraft which would give maximum loads in minimum times . . . build it around a gas in a manner best adapted to an expandable-compressible fluid for intermittent performance, according to the two engineers.

"Trail Blazers" Provide Recognition

The "Trail Blazers of Chemistry" offers a unique opportunity to the individual chemist or chemical engineer to obtain dignified and deserved recognition of his professional accomplishments. Back in 1944 the sponsors of the National Chemical Exposition conceived the idea of special non-commercial exhibits which would give a chemist or a research team a chance to present a display to the huge audience which attends these shows. These displays could illustrate any new idea, new product, process, piece of equipment, teaching device, or analytical method which had been developed.

The success of the project has been outstanding. Many of the exhibits from the seven expositions between 1944 and 1956 have later become articles of commercial importance. Among these have been the chlorophyllins used in tooth paste, soil stabilizers, and various synthetic fabrics. In addition, the exchange of ideas has helped countless others who have viewed the exhibits, and has resulted in much helpful publicity for chemists and chemistry.

Originally the exhibits were limited to three-by-four foot panels mounted in special racks. Regulations have now been broadened to include almost any type of exhibit, including operating models.

Dr. W. P. Utermohlen Jr, director of research for Velsicol Chemical Corp., is chairman of the Trail Blazers Committee for 1958. The display will be part of the 10th National Chemical Exposition at the International Amphitheater, Chicago, Sept. 9-12, 1958. This will be concurrent with the American Chemical Society national meeting. Information and regulations may be obtained from Dr. Utermohlen at the National Chemical Exposition, 86 E. Randolph St., Chicago 1, Illinois.

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C-6526 MECH. DESIGNER Grad. or equiv. 8+ yrs. in mech. bldg. facilities design in heating, vent., plbg., piping, air cond., etc. with architectural or consulting engrg. firm, sal. open dep. on exp. loc. Chgo. employer will pay the fee.

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C-6551 ASSISTANT CHEM. ENGRS. BS ChE. age to 30; 0-3 yrs. in cellulose, plastics, polymers, instrumentation, plant layout. Duties: Tech. assistance in plant operation or general engrg. work reporting to plant engr. for a chem. mfgr. of cellulose & plastics sal. $7500 loc. Tenn., employer will pay the fee.

C-6552 PROJECT ENGR. Grad. CE, San. or Mech. age 30+; 5+ yrs. as eqpt. designer. Duties: At Project Engr. level supv. small group of engrs. or sanitary eqpt. design, handle contracts, customer contact & correspondence with consultants & contractors on eqpt., etc. for a mfgr. sal. $75-8500 loc. Chgo. employer will pay the fee.

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839-MW: CHIEF ENGR. OR PROCESS ENGR. (metal working industry) 49 BSME 3 yrs. supv. & process all product engrg. changes & designs, tooling procurement of machines, estimating, plant layout, plant engrg., change material specs. when nec. cost reduction. 3 yrs. supv. & process all mfg. parts. In charge of tool designers & tool room; set up production lines, conveyor systems, estab. mech. specs, estimating, work standards, & cost reduction: plus 15 yrs. misc. exp. on radio & elect. parts, automatic stabilizers & outboards sal. $8400 U.S.

840-MW: RESEARCH ENGR. (graphic arts-paper) 59 BSME: Investigations, surveys & reports in the Graphic Arts. Research admin., research in specialty papers, duplicator & related supply field. Extensive knowl. of photography, technical writing. Teaching. $8400 Chgo. Area.

841-MW: RESEARCH, DEVELOPMENT OR DESIGN ENGR. 57 BSEE 9 yrs. exp. on domestic dish washers & vacuum cleaners. 15 yrs. devel. engr. on indust. sewing machines. 5 yrs. exp. machine design, tubular rivet machinery, automatic rivet feeding mechanisms & extruded rivet headers. min. $7200 Chgo. Pref.

Pneumatic Thrust Can Guide Missile

What makes a guided missile turn when it is outside the earth's atmosphere?

"A few pounds of pneumatic thrust from an air nozzle in space is sufficient to control and orient a huge missile in flight," said Leonard L. Baker, managing engineer of the mechanical laboratory at Chrysler Corp. Missile Operations, Detroit, Mich.

"The thrust can be obtained by a high-pressure pneumatic system for storing energy—the controlled release of high pressure gas to provide attitude control," he said.

Baker spoke at the 13th annual National Conference on Industrial Hydraulics at the Hotel Sherman in Chicago on Oct. 18.

The conference was sponsored by Illinois Institute of Technology and its affiliate, Armour Research Foundation, in cooperation with several engineering societies and more than 100 industrial organizations.

Baker said the high-pressure pneumatic system for storing energy offers the following major advantages to the ballistic missile field:

—Can be programmed automatically.
—Is simple, reliable, and lightweight.
—Requires a minimum of servicing.
—Is compatible with materials in the system.
—Can be charged rapidly and simply, offering advantages for storage and field use.

Baker cited the Chrysler missile, the Redstone, a surface to surface ballistic missile intended as a mobile field weapon for use by the Army ground forces to supplement artillery, as an example of pneumatic control.

"We have discovered that . . . the expanding field for missiles utilizing pneumatics leaves an urgent need for products which are suitable for this service," he said.

Many manufacturers are holding practically exclusive rights in the field by default alone, he explained. Missile manufacturers would be "particularly pleased" to have their development burden reduced by further improvements in these applications.

He stressed that the final product is only as good as the effectiveness and thoroughness of the test and inspection program.

Russia Still Held at Bay by U.S. Science

American scientific and technological superiority will continue to hold Russia at bay in spite of her success in launching the earth's first satellite.

Dr. John T. Rettaliata, MWSE, president of Illinois Institute of Technology, expressed this belief in Chicago Oct. 12 before the Chicago Area Science Conference of the Chicago Teachers Science Association at the University of Chicago.

Speaking "In Defense of Science," Rettaliata pointed out that scientific and technological superiority has enabled the United States to check successfully the menace of Russia's competing order to our social system.

"I am confident that, by maintaining that superiority, we can continue permanently to quarantine that force of evil," he said.

". . . I say this with full recognition that Russia, in launching the first artificial satellite last week, apparently is temporarily ahead of us in this particular enterprise."

Countering the prevalent fear that science and the limitless power suddenly pressed into man's hands by the atomic bomb have given man a great potential for evil, he added hopefully:

"If the atomic bomb suddenly and vastly has widened man's possible choice of good or evil, further advances in atomic knowledge, and other discoveries that are imminent, are widening it even more."

"They are widening it so greatly and rapidly," he said, "that I cannot but reach the conclusion that the choice of evil use is about to become virtually impossible."

Even behind the Iron Curtain that impossibility is becoming increasingly evident, he added.

Science steadily has been moving considerations of good and evil to a top place in the thoughts of man everywhere.

Science is compelling all men to think in terms of ultimate values and ultimate ends, he said, and it is making men think in terms of the whole of mankind.

The Illinois Tech president sees science and its advance turning out to be, not the spectre it may temporarily seem to be, but a force that is hastening the process of man's moral and spiritual development.

"It is my conviction," he said, "that science and technology are having profound and beneficial effects upon our social order."

"It is my belief that science is providing us with the means to attain many of the age-old goals of the idealists, and that it is laying the foundation upon which we can ultimately build the moral and spiritual order that the heart and soul of man always have craved."

Asserting that none of this could have come about except for the part played by the individual, he said, it is the individual who must devise the means to achieve the increased productivity necessary in our future existence.

"In particular, the scientist and the engineer will bear the major burden in bringing into reality the potential in store for us," said Rettaliata.

"Competent management, as always, will furnish the medium through which creative forces ultimately produce a useful product; but the basic dependence of the economy will be upon science and technology."

Reviews of Technical Books

Industrial Trucks

The Handbook of Powered Industrial Trucks, Industrial Truck Association, Washington 4, D.C., 1957. Pages, 96. Price, $5.00.

This is possibly the most complete and authoritative handbook ever developed on the subject of industrial trucks. It is the result of nearly three years' effort on the part of various Association committees. It is divided into five sections: industrial truck applications; cost savings through industrial truck handling; planning for and selection of industrial trucks; industrial truck engineering data; and industrial trucks and the future.

The publication has been designed to answer the needs of purchasing, operating, production, maintenance and material handling personnel in all industries. It contains dozens of case studies showing specific industrial truck applications, as well as nearly two hundred illustrations of various truck types, attachments, containers and load carrying devices. In addition, numerous engineering tables, graphs and charts are used to present practical truck operating data.

One section is devoted to proper selection of trucks; other material has been developed to aid a company in driver training and proper preventive maintenance programs and procedures.

Almost every conceivable truck application is, likewise, covered to enable the plant operating or material handling man to properly apply his powered rolling equipment for maximum efficiency.

All types of motive power are detailed with information included on selection of the best type of power according to the operations required.

Flow of Gases

Molecular Flow of Gases by G. N. Patterson, John Wiley & Sons, Inc., New York 16, N. Y. 1956. Pages, 217. Price, $7.50.

Introducing a new approach to fluid mechanics, *Molecular Flow of Gases* was designed to facilitate a transition from the continuum to the molecular viewpoint, but includes sufficient material from both the kinetic theory of gases and fluid mechanics to develop and illustrate the molecular approach.

In this book the characteristics of a gas flow are determined from an assumed molecular model and the distribution of the velocities of the molecules. The macroscopic properties of a frictionless, compressible (isentropic) flow are obtained from a simple spherical molecule and Maxwell's distribution law. A more complicated molecular model (point center of force) and a small order modification of Maxwell's distribution function are required in the corresponding calculation for a viscous, compressible (slightly nonisentropic) flow. The weak shock transition and the boundary layer are examples of this type of motion. The molecular concept permits the determination of both the equations of motion of a gas and the boundary conditions at the surface of a body. These results lead to the concepts of slip flow and temperature accommodation in a rarefied gas. The same basic ideas are used to develop the theory of free-molecule flow.

Since sufficient collision information for diatomic moleculares is not available, the mathematical development in the book is complete only for nonatomic gas. However, as Dr. Patterson points out, the results apply equally well to a diatomic gas (air) if the appropriate changes are made in the values of the ratio of specific heats and the Prandtl number.

Individual chapters include: the fundamental equations, isentropic flow, basic equations for nonisentropic flow, nonisentropic flows, and mechanics of rarified gases. The appendix covers mathematical aids, differential equations and their characteristics, and a summary of the derivation of the basic equations of motion of a gas according to molecular theory—Burnett equations.

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Oxo Alcohols

Higher Oxo Alcohols, by Lewis F. Hatch, John Wiley & Sons, Inc., New York 16, N. Y. 1957. Pages, 120. Price, $4.50.

A review of the extensive patent literature on the oxo process, together with information on production and utilization, appears in this book. Lewis F. Hatch, the author, is technical consultant for the Enjay Laboratories.

Because relatively few papers exist relating to the catalyst or the reaction mechanism, Dr. Hatch has combed all available sources. The material he supplies on the industrial utilization of higher oxo alcohols was obtained primarily from product bulletins and other publications of the Enjay Company and Enjay Laboratories. It is these industrial aspects that are stressed, with ample attention given to theoretical background.

As Dr. Hatch points out, the oxo reaction for the production of aldehydes and alcohols from olefins, carbon monoxide, and hydrogen is unique. A complete summation of its practical application to plasticizers, detergents, synthetic lubricants, and agricultural chemicals constitute the bulk of the volume.

Dr. Hatch, author and co-author of a large variety of books and papers, was previously affiliated with the Dow Chemical Company and the Shell Development Company, and since 1940 has been on the faculty of the University of Texas.

Employee Attitudes and Safety

The employee who has frequent industrial accidents is likely to be one with poor safety attitudes, according to a study recently completed at New York University's Center for Safety Education. Dr. Earle Hannaford, who conducted a survey of 769 male employees and 481 male supervisors from 54 industrial organizations, also concludes that employees working for supervisors with poor safety attitudes tend to have more accidents.

"We have been looking for several years for some clear-cut evidence of the importance of faulty attitudes as causes of industrial accidents," Dr. Walter A. Cutter, director of the Center for Safety Education, said in discussing the results of Dr. Hannaford's study, which are reported in a doctoral dissertation. The study also produced two safety-attitude tests that the NYU safety center will publish in the near future. "These tests should have real value in strengthening industrial safety programs," said Dr. Cutter. They were developed by Dr. Hannaford with the cooperation of 450 industrial organizations.

In his survey Dr. Hannaford tested groups of 20 accident-free male employees and groups of 20 with one or more disabling injuries in the five-year period 1948 to 1952. He found a positive relationship between safety attitudes and accident experience and a significant difference between the safety attitudes of accident-free employees and those with one or more disabling injuries. He also found a positive relationship between the safety attitudes of supervisors and the accident experience of the employees they supervised.

Dr. Hannaford concludes that the time, money, and effort spent in developing and maintaining good safety attitudes are amply justified, and that the use of safety results to judge employee and supervisory performance for purposes of advancement is sound.

Dr. Hannaford, who received his Ph.D. from the New York University School of Education in October, is a safety engineer for the long lines department of the American Telephone and Telegraph Company. A graduate of Tufts College, he obtained a master of science in electrical engineering degree from Georgia Institute of Technology in 1927. He has taught at both NYU and Georgia Tech.

Widely known in the field of industrial safety, Dr. Hannaford has served as general chairman of the public utilities section of the National Safety Council. He is the author of a number of texts in engineering and management and numerous articles and treatises on safety.

Northwest U.S. is Heat Pump Center

The northwestern section of the United States, in particular Oregon and Washington, will strengthen its position as "heat pump center of the world" during 1958.

That's the prediction of J. P. McDermott, manager of The Trane Company sales office in Portland, Oregon. Trane is a leading manufacturer of air conditioning and heating equipment.

In LaCrosse, Wis. to meet with Trane officials, McDermott singled out Oregon and Washington as centers of more heat pump activity on big installations than any other area.

He said, "We see a growing trend by utilities and corporations to give heat pumps a complete analysis when installing both heating and cooling."

As recent examples of this growing trend, he pointed to the Tacoma City Light Department, Tacoma, Washington; the McNary Dam powerhouse, McNary, Oregon; Dalles Dam powerhouse, Dalles, Oregon; Clark County Public Utility District Office, Van Couver, Washington; Washington Water and Power office building, Spokane, Washington; and the Detroit Dam powerhouse, Detroit, Oregon.

"These are all relatively recent Trane heat pump installations," said McDermott. "And they all are saving money on combined heating and cooling bills. It is on the big installation that real money saving economies are available in this area."

In other aspects of the air conditioning field, McDermott noted increased interest on the part of schools to air condition so that 12-month use of buildings could be effected, that no first-class office building has gone up in the area in the past year without provision for comfort cooling, and that air conditioning is rapidly moving from the luxury to the necessary category in both states.

Enrollment is Up

Enrollment at Illinois Institute of Technology continues upward, according to a final count for the 1957-58 fall semester released in Chicago on Oct. 4.

A total of 7,809 graduates and undergraduates have registered for day and evening classes, said Dr. John T. Rettaliata, MWSE, IIT president. Last year's total was 7,568 students.

The fall semester registration figure at IIT represents a new high, exceeded only by the peak post-war years when 8,378 students were enrolled, according to Rettaliata.

The enrollment breakdown follows: 2,043 day undergraduates and 226 graduate day students, for a total day enrollment of 2,269; 4,680 evening undergraduates and 860 evening graduate students, for a total evening division enrollment of 5,540.

News of Engineers

A specialist in analysis instrumentation and computers has been named assistant research director at the Institute of Gas Technology of Illinois Institute of Technology, Chicago.

The promotion of Duane V. Kniebes from head of the analytical division to assistant research director was announced by Dr. Martin A. Elliott, IGT director.

Kniebes will be responsible for research activities in the Institute's analytical division and the computer laboratory. The Institute of Gas Technology is the gas industry's educational and research facility.

He joined the Institute of Gas Technology in 1949 as an assistant chemist and was promoted to head of the analytical division in 1954.

A 1948 graduate of Michigan State University, Kniebes received his B.S. degree in chemistry. In 1954, he was awarded an M.S. degree in physics from Illinois Institute of Technology.

* * *

Ralph S. Peterson, MWSE, division vice-president of Commonwealth Edison Co. has completed his 35th year with that organization. He was first employed by Commonwealth Edison in 1922 as a draftsman.

Peterson was graduated from the Lewis Institute of Technology.

* * *

Harry J. Watson, 34, has been promoted to manager of The Trane Company, La Crosse, Wisc., service department, according to Vice President A. C. Menke.

Trane is a leading manufacturer of air conditioning, heating and ventilating equipment.

The firm's service department works directly with sales engineers and air conditioning and heating service engineers throughout the United States.

As manager, Watson will provide close liaison for the Trane service network of 36 agencies. He will play an important part in the firm's service literature and service parts programs.

Watson, a 1952 mechanical engineering graduate of Wisconsin, joined Trane in early 1956 as assistant service manager. Prior to this he was a regional service supervisor for a major air conditioning and refrigeration equipment manufacturer and an engineer for a refrigeration contractor.

* * *

Two scientists were cited in Chicago on Oct. 7 for papers presented at previous meetings of the National Electronics Conference.

Leon Brillouin, New York City science consultant, received the NEC Award of Merit for his paper on "A Theorem of Larmor and Its Importance for Electrons in Magnetic Fields," presented at the 1944 NEC meeting.

The NEC Annual Award was presented to Dr. Isaac M. Horowitz, Polytechnic Institute of Brooklyn, for his paper on "R-C Transistor Network Synthesis," which he gave at the 1956 conference.

Both citations were made at the luncheon meeting of the 13th annual National Electronics Conference which opened Oct. 7 at the Hotel Sherman in Chicago.

The NEC Award of Merit, consisting of $750 and a certificate, is made to the author of a paper presented at any preceding conference, whereas the NEC Annual Award, $500 and a certificate, is for a paper presented at the preceding year's conference.

The Award of Merit was established to honor the author or authors of a paper which, in the opinion of the awards committee, introduced developments of a new and revolutionary character capable of significantly influencing an electronics field, or of opening a new major area of electronic science or application.

Scholarship, originality, importance, and clarity are the bases upon which the Annual Award is presented.

Brillouin's paper is regarded as "being of paramount significance by scientists working with microwave electron tubes such as those used in radar and high frequency communications."

One facet of the practical importance of Brillouin's concepts is the resultant reduction in weight, volume, and power required in microwave equipment due to the more efficient beam focusing methods. It has been estimated that the saving in weight of radar and electronic equipment thus effected in a large military airplane amounts to almost half a ton.

The synthesis method described in Horowitz' paper "represents a contribution of major importance to the advancement of electronic art." The theory and techniques described by this paper "will have a number of commercial and military applications in telephony and general communication theory," according to the awards committee.

* * *

Colonel Herbert Milwit, who recently completed a three-year tour of duty in Japan, is the newly assigned assistant division engineer, U. S. Army Engineer Division, North Central. Colonel Milwit joins the staff of Brigadier General Louis J. Rumaggi, division engineer. Colonel Roland C. Brown, former assistant, is now deputy.

For his meritorious service as deputy engineer and chief of the Intelligence Division, Office of the Engineer, Headquarters United States Army Forces, Far East, and Eighth United States

Army, Japan, from 15 September 1954 to 14 August 1957, Colonel Milwit received the Commendation Ribbon with Metal Pendant. He also holds the Legion of Merit, the Bronze Star Medal, the Order of the British Empire, the Croix de Guerre, and the Order of Leopold II.

The North Central Division, 536 South Clark Street, Chicago, is currently supervising work on three major navigation projects in the Great Lakes region. The first of these is the United States portion of the St. Lawrence Seaway with the Corps of Engineers is building as design and construction agency for the St. Lawrence Seaway Development Corporation. Also well begun is the project to deepen the connecting channels of the Great Lakes. This project exceeds by far any previous undertaking of this type during the Army's 133-year experience on the Great Lakes. The third major project is the $190,000,000 Calumet-Sag Navigation Improvement to provide an adequate and modern connection between the Great Lakes and the inland waterway system.

Automatic Electric Occupies New Home

On April 16, 1956, ground was broken for the new plant of Automatic Electric Company in Northlake, Illinois. Eighteen months later, the entire operation was in its new Northlake home.

From a tiny workshop where the first automatic telephones were made, Automatic Electric has grown with Chicago. Although the facilities on Chicago's near west side were housed in 17 buildings in a three quarter square mile area, the company needed room to grow still further and wanted consolidation. Since growth in the limited land area available was impossible in its old plant, Automatic moved 15 miles west of Chicago's loop to what was once a site occupied by the Westward Ho Country Club. A winding creek ambles across the front and the entire plant area is being landscaped with shrubs, trees, rolling green lawns and flower beds.

The new plant is, in fact, a "city under one roof." Automatic Electric's plant contains more than 35 acres of floor space under one roof which, to put it another way, would be sufficient space upon which to place the playing fields and stands of the athletic stadiums of all the Big Ten Schools.

Size, however, does not detract from the efficiency of this plant, which compares with a city of 10 to 12 thousand population. The electrical power transformers and two water reservoirs could supply a city of such size. The power house could provide steam heat for 1000 houses. The paving used in plant floors, roads and parking lots would be sufficient to make 56 lane miles of highway. Automatic has its own police force, fire-fighting equipment, and more than enough telephones to handle communications in such a mythical community. The cafeterias in the plant seat 2100 persons at a time and are capable of serving 10 thousand or more meals daily.

Probably the most unusual single construction feature of the plant is that the roof and floor slabs of the one-and-two story office and research section were actually built on the ground level and hoisted up into place by hydraulic jacks. This is believed to have been the first time "lift slab" construction has been employed in the Chicago area.

As a result of this move to their highly efficient plant embodying all the advantages of advance planning, the current working force of 8,000 is expected to be increased in the future to 10,000. The new plant is now enabling Automatic Electric Company, a pioneer in the field of automatic telephone communications, to serve the communications industry more ably.

Steam Plays Role In Missile Program

Steam assumed an important role in the development of the nation's guided missile defense program recently when The Babcock & Wilcox Company announced it will furnish the boiler and related generating equipment at the Research & Development Center being built by Thompson Products, Inc.

Located on a 1050 acre site approximately 20 miles south of Roanoke, Va., the Center will use the steam generated by the B&W equipment exclusively for conducting research projects, including the testing of components for missile system experiments with monopropellant and bipropellant fuels. To simulate conditions at actual operational altitudes of the missile, steam will be used to operate the steam ejectors which exhaust both the turbine discharge and the experimental test chamber. The steam will also be used as a heat source for preliminary heating to temperatures of 300 degrees F.

The boiler has a design pressure of 300 pounds per square inch, gage, and will deliver saturated steam at 275 pounds per square inch, gage. Its normal capacity will be 40,000 pounds of steam per hour. Because of the unusually heavy contamination of the process steam due to entrained products of decomposition and combustion, condensate will not be returned to the boiler. Thus, 100 per cent of the ejector steam when condensed will be discharged to the sewer.

B&W has utilized an outdoor design of the unit for a semi-outdoor installation. About one foot of the front of the boiler will project into the enclosed boiler room to allow indoor control. This arrangement, advanced by McConathy, Hoffman & Associates, Inc., of New York, consultants on the project, will save Thompson Products, Inc., both construction space and cost.

WSE Applications

In accordance with Article I, Section 5 of the By-Laws of the Western Society of Engineers, there is published below a list of applicants for admission received since the last issue of the MIDWEST ENGINEER magazine.

Ernest R. Seymour, Architect; Plumb, Tuckett & Pikarsky, 25 E. Jackson Blvd.

Frederic C. Thompson, 1368 Sedgwick St., attending Northwestern University.

James Brown, District Manager, Morse Twist Drill & Machine Co., 571 W. Randolph St.

Albert S. Vengris, Vice President, Venta Engineering Co., Inc., 21 E. Van Buren St.

Diesel Electric Train Is Commemorated

Development of the Diesel-electric locomotive was commemorated Oct. 10 by presentation of the 1957 Elmer A. Sperry Award at a luncheon in Morrison Hotel, Chicago as part of the annual Fall General Meeting of the American Institute of Electrical Engineers.

The ceremonies marked the first time a major American engineering honor has been conferred upon a group, as opposed to the usual custom of selecting a single central figure.

The Sperry Board of Award, composed of two representatives each of the American Institute of Electrical Engineers, American Society of Mechanical Engineers, Society of Automotive Engineers and Society of Naval Architects and Marine Engineers, conferred the award with the citation: "For development of the Diesel-electric locomotive which helped revolutionize American railroading." Recipients were three early leaders in the development and all members of four sections of the engineering department of Electro-Motive Division of General Motors Corp., at LaGrange, Ill., who served in the period up to and including 1940. Those honored were:

Harold L. Hamilton, of Los Altos, Calif., retired vice-president of General Motors, founder of Electro-Motive, and the leader of the company throughout the period in which it developed the Diesel-electric locomotive.

Richard M. Dilworth, of Hinsdale, Ill., retired, who was chief engineer of Electro-Motive from 1926 to 1951 and, as such, headed the research and design work which resulted in the first successful application of the Diesel engine as a prime mover for propulsion of trains of all classes.

Eugene W. Kettering, of Hinsdale, Ill., now director of research of the Electro-Motive Division, who, from 1936 to 1942, was in direct charge of the development of the General Motors 567 series Diesel engine. This engine was the major element in broadening the capability of the Diesel-electric locomotive to cover all phases of domestic railroad motive-power needs.

Electrical Engineering Section, Electro-Motive Engineering Department, represented by Boyd B. Brownell, of LaGrange, Ill. Head of the section prior to 1940, Mr. Brownell now is Electro-Motive's Chief Engineer.

Mechanical Engineering Section, represented by Lester O. Parker, of Clarendon Hills, Ill., now a supervisor in the section and a member prior to 1940.

Locomotive Section, represented by Ludvig Petersen, of Westchester, Ill., now Chief structural engineer of Electro-Motive and a member of the group that developed the car body and trucks prior to 1940.

Controls Section, represented by Torsten O. Lillquist, of LaGrange, Ill., now an electrical research engineer for Electro-Motive and a member of the group that developed the controls prior to 1940.

The awards were presented by Robert B. Lea, of Lake Success, L. I., N. Y., a director of Sperry Products, Inc., of Danbury, Conn., and chairman of the Sperry Board of Award, as a representative of the American Society of Mechanical Engineers, and by Edward H. Anson, of New York, representing the American Institute of Electrical Engineers.

Other members of the Award Board are: David Morgan, American Society of Mechanical Engineers; W. N. Zippler, American Institute of Electrical Engineers, Jerome C. Hunsaker and William Littlewood, Society of Automotive Engineers; and Herbert L. Seward and C. Richard Waller, Society of Naval Architects and Marine Engineers; with C. L. Davies, secretary.

The Sperry Award was instituted and first presented in 1955 to commemorate the many achievements of Dr. Elmer A. Sperry, especially in the field of transportation. It may be given each year for a "distinguished engineering contribution which, through application proved in actual service, has advanced the art of transportation, whether by land, sea or air."

Interesting sidelight of the presentation was the presence of Charles F. Kettering, 82, who himself holds many of America's top engineering citations for his research in the automotive and other fields. Seated at the speakers' table, he saw his son, Eugene, receive the Sperry Award.

Cathodic Protection Battles Corrosion

Cathodic protection has, within a surprisingly few years, advanced from a curiosity to a standard accepted method of combatting metal corrosion, the Fall General Meeting of the American Institute of Electrical Engineers was told in Chicago on Oct. 11.

"Cathodic protection," said B. Husock, of the Harco Corporation, Cleveland, Ohio, "has shown itself to be one of the most versatile and effective methods of combatting of underground and underwater metallic surfaces. Within a relatively few years it has advanced to a position where it has become incorporated as original equipment in many structures. Although there have been many recent developments in the techniques and materials for cathodic protection, the major development in the past few years has been the tremendously increased scope of the activity in the field. This is particularly true in the application of cathodic protection to the underground pipeline. The phenomenal success it has achieved in that field has inspired developments for many other applications, especially in the marine industry. It is not unreasonable to assume that the usefulness of cathodic protection will continue to expand and that new refinements and techniques will increase its ability to reduce our large corrosion costs."

In a technical paper, "New Developments in Cathodic Protection," presented at a symposium on the chemical industry. Husock said that in addition to widespread use on underground pipelines, cathodic protection is being used to combat fresh water corrosion in storage tanks, in lock gates and dams, in heat exchangers and condensers, in refineries and breweries.

Its salt water applications include, ships, inside and out, electric generating stations located on salt water, barges, tugs, dredges and floating dry docks, also on the submerged parts of the Texas Towers, anchored off-shore for radar protection of the United States, he said.

Research and development programs for cathodic protection have been set up by the navies of the United States, Great Britain, and Canada, he said, adding that the U. S. program "is an intensive one in which all aspects of corrosion control are under consideration. It includes research studies of criteria of protection, hydrogen evolution, and the effect of cathodic protection current on coating as well as development work on anode materials, design and configuration. Instrumentation and automatic controlling devices are being developed. Other materials of construction are under development, such as cabling, stuffing tubes, switchgear and anode holders. Installations on active ships have been made and evaluated. As a result of all this activity it is expected that the marine industry will benefit in many ways. Among the expected benefits are lengthening of time between dry-dockings, reduced thickness of hull scantlings, the elimination of plate replacements for corrosion reasons and material selection based on mechanical and weight considerations rather than for corrosion resistance.

Husock said that the corrosion problem of stationary ships has "apparently been overcome" and the hulls of most of the ships in the mothball fleet have been provided with cathodic protection.

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Education Adequacy Challenged

The adequacy of liberal arts education in today's technological civilization was challenged Oct. 21 at the annual meeting of trustees of Illinois Institute of Technology in Chicago.

President John T. Rettaliata, MWSE, in his report to the board at the Chicago club, declared that in an industrial society any curriculum "not broadened to the extent of including an understanding of science and technology is not balanced or relevant and, therefore, not liberal."

Urging that science be a requirement in the curriculum, the educator added:

"A proper liberal program prescribes areas of learning which permit the student to grasp the significance of tradition and history.

"Modern liberal education can exclude science no longer. In the past, most of science's research efforts were of a pure or fundamental nature, primarily of interest to the laboratory or classroom.

"Today the situation has changed to the extent that practically all research is of the applied type, which means it has a current effect on society.

"The liberally educated man obviously must be cognizant of this effect."

Rettaliata said strengthening of the engineering curriculum in the fields of the humanities and social sciences has been a major development in technological education.

He explained that changes and extensions have steadily been effected to broaden the base of engineering education to develop the potentialities of widest effectiveness in an industrial civilization.

Education's goal, he continued, must be more understanding of social problems by the scientist, and more understanding of science by society generally.

"If it is important for the engineer to understand economics, and the implications of history and the arts, certainly, it is equally important that students pursuing a liberal education understand some of the problems and results of science and technology, and the facts of the nation's industrial growth."

The Illinois Tech president said that growing emphasis on technology and research will result in increased graduate study.

"The badge of admission into the engineering profession," he added, "will gradually move from the bachelor's degree to a higher degree as the increasing complexity of industrial operations necessitates longer periods of preparation."

Rettaliata's report hit at charges that the youth of the country is being "high-pressured" into studying engineering and that technological education has been given emphasis at the expense of the liberal arts and humanities.

He cited figures comparing freshman engineering enrollments with total first-time college male enrollments and showing little percentage change in recent years. The 1956 freshman engineering enrollment was 17.4 per cent of first-year men. This figure has not changed one percentage point in the last four years.

Rettaliata also reported that Illinois Tech assets on Aug. 31, the end of the fiscal year, amounted to $37,200,000, compared with $38,418,870 a year earlier.

The 1957 total included land, buildings, and equipment valued at $28,225,000, a gain of approximately $2,650,000.

Consolidated annual budget income was placed at $20,380,000, the highest in the Institute's history and a gain of $3,000,000 over the Aug. 31, 1956 total.

Discussing progress in the campus development program, Rettaliata reported that a new engineering laboratory of the Association of American Railroads research center was completed, and an electrical engineering and physics classroom and laboratory building was near completion at the end of the year. Although not scheduled for completion until next month, classes are being held in the latter building. The new AAR building will be dedicated in November.

Other construction started during the year included a four-story addition to the metals research building of Armour Research Foundation and an addition to the campus heating plant. At the year-end, 24 of more than 50 buildings planned for the campus were completed or under construction.

Auxiliary Systems Should be Grounded

As the size of power stations has increased it has become economical to increase voltage on auxiliary systems to 4160 volts, thereby raising the question of whether or not to ground the systems.

Although an exact answer cannot be given, grounded systems were given the green light in Chicago on Oct. 9 at the Fall General Meeting of the American Institute of Electrical Engineers, in a paper, "Grounding of Power Station 4160 Volt Auxiliary Systems," presented at a power generating symposium by T. H. McGreer, of Westinghouse Electric Corp., Chicago.

After discussing the problem pro and con, McGreer said that "Auxiliary systems at 4160 volts should be grounded in order to minimize multiple insulation failures. Added insurance against a first ground failure is a dividend.

"Resistance grounding is preferred because of decreased fault damage, elimination of high voltage gradients and reduction of induced voltages in adjacent circuits.

"Relaying for ground faults is as good or better for the resistor grounded system."

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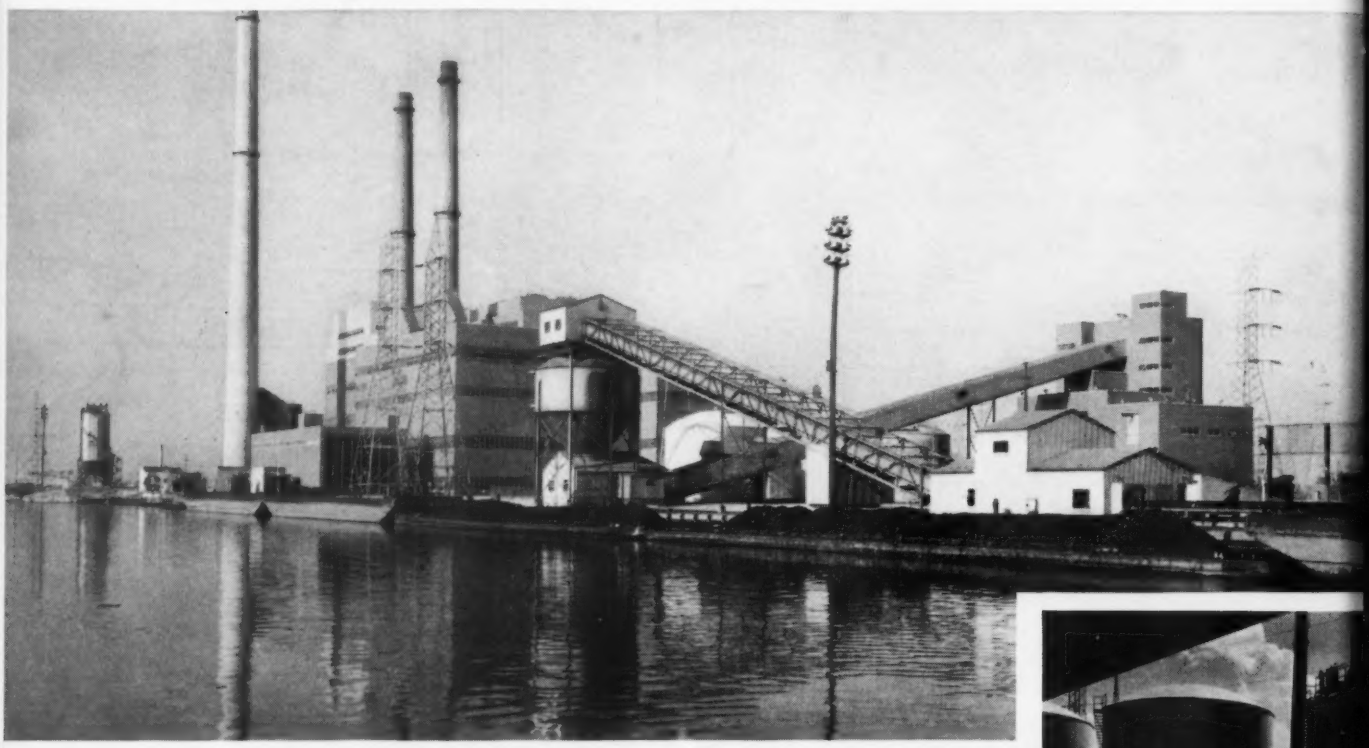

Will County Generating Station looking from the edge of the Illinois Waterway.

Without water there could be no electric power industry as we know it today.

Without an adequate water supply, there could be no huge, modern generating stations producing electric power at a fraction of the previous cost.

To operate effectively and economically, a modern steam generating station needs water in quantity. Take the newest of Edison's 12 stations (Will County) for example. Approximately 3,900,000 pounds of steam per hour are required to maintain full-load operation on the three turbine-generator units. The net capability is 580,000 kilowatts.

The water for this steam must be chemically pure. So it has to be demineralized. Two 400,000 gallon storage tanks are required to maintain an adequate supply.

Then to condense the steam back into water for re-use in the boilers after it has worked in the turbines requires about 775,000,000 gallons of river water per day. Another 25,000,000 gallons of river water is needed daily for other station operations—screen washing in the cribhouse, ash sluicing and cooling. All of the river water is returned to the river.

Finally, a third 400,000 gallon storage tank provides domestic water for general use. Three deep wells supply the storage tanks, to meet the daily requirement of 290,000 gallons of domestic and demineralized water.

Providing and maintaining the right kind of water for steam generation presents challenging problems that require the talents and skills of many different kinds of engineers:

Engineers Mike Morris (left) and [illegible] Claeson look over prints for the 400,0[illegible] gallon boiler feed water demineraliz[illegible] tanks.

Civil, Structural, and Architectural—to design and supervise dockwork, water intake, and discharge structure construction.

Hydraulic—to determine and control the rate of flow of water.

Mechanical—to determine specifications and supervise erection of boilers, pumps, piping, turbines and condensers.

Electrical and Electronics—to provide driving equipment, and electrical and electronic controls for pumps, turbines, and boilers.

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